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THE COUPLING OF ENGINES.

By

Paul Boccaccio.

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NOT TO BE TAKEN FROM THE ROOM

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THE COUPLING OF ENGINES.

By

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The first impression we experience at an Aviation Meeting, or when inspecting an aeronautical Exhibition, is that of astonishment at the number and diversity of the ideas realized and incorporated there.

A closer examination of the machines brings two main classes to the fore, - single-engine and multi-engine airplanes.

The single-engine airplanes, with one fuselage and one propeller, are remarkable for the simplicity of their construction, the grace of their lines and the impression of strength and security which they manage to convey. And the undeniable analogy existing between all these airplanes of different make, hailing as they do from various countries, leads us to feel, as in the case of the up-to-date automobile, that a rational solution has been arrived at with regard to single-engine airplanes.

On turning to the multi-engine class, we find a striking lack of unity, of homogeneous character, of harmony, so to speak, - though exception might be made in the case of the Goliath - in spite of the daring solutions of different problems and occasional originality of ideas that impress us at the first glance.

A critical mind, with no inclination to be carried away by colossal dimensions, cannot avoid noticing the slightness of the liaison between the engines in themselves, and of the manner of their distribution, differing as it does according to the type of airplane and which allows neither of their being overhauled nor repaired during flight; then there is the forest of supports to be considered, the struts, the wire cables, permanent brakes of the airplane, the unbalancing caused by the sudden stoppage of an engine (so dangerous at the time of starting), the risk of a lateral landing at a point far distant from the mass of the airplane; and none of these inconveniences exist in the case of an airplane with a single engine. It may even be a matter of astonishment that the two classes, so unlike in many respects, continue to exist side by side. This is a question which depends far more on the power of the engine than on considerations of safety.

The first double engines used in wartime were constructed in order to carry greater weight and climb higher than airplanes equipped with only one of these engines.

Since that time, the manufacturers have been obliged to continue along this line owing to the ever-increasing need for higher power; urged on by the demand for rapid execution, which left no time for prolonged and delicate finish, they thus turned out machines that became more and more complicated and consequently more and more difficult to pilot. The relatively low

power of our engines would never enable us to entertain hopes of any other solution, and we shall never satisfactorily solve the problem of the heavy airplane, following in the path already traced out by the light airplane, until we obtain a sufficiently reliable and powerful engine.

There being no such powerful engine - or at least not in quantity production - it may naturally be asked why several engines could not be coupled together (as in the case of submarines or airships) on the same propeller. These engines, equipped with engaging and disengaging gear, automatic or better still, semi-automatic, would transmit their power to the propeller-shaft, just as several locomotives coupled to a train transmit their thrust.

Momentary defaults on the part of one engine would be supported by the others, and in the case of an accident to any one of them, the engine in question would automatically release itself. A central or side passage would render it possible to overlook the engines, to change the spark plugs and to do chance repairs. An engine might be stopped, for instance, repairs might be done or a defective part changed, and the engine would then be re-connected, thus avoiding the majority of the causes of breakdown. Provision might even be made by means of a three-way cock for the connection of an additional radiator on one of the water circulations of the engines; this radiator could either be used to cool one of the engines or to "discon-

neot" a damaged radiator. This system might likewise be applied to gasoline and oil circulations. The reducing device would facilitate the use of a propeller of variable pitch and diameter.

The safety in working of such a group would thus be far better insured than by the ordinary method, in which the engines are inaccessible.

We shall now see what advantage may be gained by this arrangement, from the manufacturer's point of view, by comparing an airplane with a triple 300 h.p. engine of the present type, with 3 engine beds and 3 propellers, with a similar airplane having three engines coupled together (one fuselage and one propeller).

The tests of an airplane of the first-named type give a useful load of 1.100 kg. without fuel. The fact that two engine beds and two cowls can be done away with on the second airplane, that there is one propeller instead of three, one set of moorings, one generator and a single starter, - the simplification of the piping, pumps and auxiliary tanks, all this will mean a gain of about 300 kg. If, on the other hand, we consider a cellule element with a drag that may be exactly equal to the drag of two lateral engine beds and their supports (original and induced resistance), it possesses a certain lift, which may be estimated at about 600 kg.

The efficiency of a propeller with reducing gear being 6% to 7% higher than that of an ordinary propeller, this increase

may be assumed to equal an excess load of 200 kg.; that is, a total gain of 1,100 kg. Such reasoning is evidently not very exact, but it may be anticipated - all other conditions being equal - that the useful load carried may be double that of the first airplane, while the airplane employed would be simpler, more reliable, easier to maneuver and considerably less costly.

Other advantages may be mentioned as follows:

Facility in installing a turbo-compressor.

Greater convenience in piloting when an engine is stopped.

Greatly reduced vulnerability, the radiators and piping forming a more restricted target through being less dispersed.

Better front sighting; less danger in case of capsizing, the passengers being in the rear.

Finally, the single propeller will be of stronger construction than an ordinary propeller, while the breakage of a blade need not entail the fracture of a wing or damage to the fuselage on account of the propeller's being placed well forward.

Some few cases of coupling have already been realized.

In Italy, the engineer Rosatelli has coupled three Fiat engines on one and the same propeller. The three engines, with vertical cylinders, are arranged fan-wise and drive the propeller shaft by means of pinions.

In France, four Breguet-Bugatti engines have been coupled together on the "Leviathan," and were studied in a remarkable manner by M. Riffard. These four engines really form two engines

placed one above the other; they drive a wheel of the propeller shaft by means of pinions.

In Germany, there are many airplanes equipped with coupling.

The giant airplanes with five engines had those engines installed in lateral fuselages - originally independent - coupled on the same propeller.

The "Linke-Hoffman" was equipped with four Mercedes engines in the same plane.

German reports (FLUGSPORT 9/7,19) establish the remarkable efficiency of that airplane, which flies and climbs with a useful load of 3.400 kg. with two engines only, thus making a reduction of 20 kg. per h.p., whereas no French or Allied airplane can fly without danger with more than 15 kg. per h.p.

This proves that the problem of coupling has certainly not been solved as yet.

It would be necessary to find extremely pliable and light releasing gear, to avoid the shock of vibrations felt in the coupling, and to avoid differences between the teeth of the different pinions, which might give rise to shocks and breakages.

To sum up, the advantages of coupling are such that the solution of these different problems should be investigated unceasingly, with a view to embarking powerful airplanes in the rational path that has already been traced out by the light airplane.

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